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## COMMENSAL RODENT CONTROL

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**SUMMARY:** Federal Urban Rat Control Program grants were awarded to cities in different areas of the United States. Severe problems of rat infestations have been detected in many of the cities by the Environmental Health Service. Approximately 20% of 3.8 million people in the project areas were occupying homes infested with rats. Control operations are now in effect in all cities, and the living conditions of the people have been substantially improved. An increase in interest in rodent control also is evident in countries outside of the United States. The Technical Development Laboratories of the National Communicable Disease Center are participating in the World Health Organization program of research on new rodenticides. The evaluation program involves five steps which carry a candidate toxicant from laboratory phase through field testing. Acceptability and suitable concentrations of both acute and accumulative rodenticides are determined. Observations are made on the hazard of the compound to pets and to other nontarget vertebrates. Laboratory and field studies have been completed on a new, promising stabilized scilliroside glycoside which has given excellent control of the Norway rat in 16 out of 19 premises. Another new coded compound has shown a unique specificity for roof rats as compared to Norway rats. Although anticoagulant resistant rat populations have occurred in several countries in Europe, as yet no evidence has been noted of such resistance in rats in the United States.

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Interest in and emphasis on commensal rodent control have been increasing over the past several years. Among the factors responsible for these developments have been the growing awareness and accompanying interest of the general public in our environment. Efforts to improve conditions, particularly in urban areas where sanitational and economic levels foster the development of rodent populations, have stimulated governmental assistance. The Federal Urban Rat Control Program which originated with Public Law 90-174, the "Partnership for Health Amendments of 1967" is aimed at the problem. This law authorized an increase in the Federal funds that could be appropriated for grants under Public Law 89-749, the "Comprehensive Health Planning and Public Service Amendments Act." Rat control is one of the public health problems for which state and local agencies may obtain financial aid under Section 314-E of Public Law 89-749. The grants cover health needs of limited geographical scope or of special regional or national importance, and the funds can be used to stimulate new program studies or demonstrations. The money available under these grants is limited and competition for it has been extremely keen.

The programs stemming from the above laws are directed toward the problem of rats in urban situations, with strong emphasis on control activities in the impoverished areas of cities. The goal is to reduce the rodent populations and conditions conducive to rodent infestation to a level where they are no longer a public health hazard and have no economic effect upon the community.

The objective of the program is the immediate and long-term reduction of rat populations with the accompanying reduction of rat bites of infants. Major emphasis is placed on the education and motivation of citizens in the principles of environmental sanitation to reduce and prevent rat infestation and to improve the livability of the disadvantaged areas. Provisions are made for employment, training, and new career opportunities for the residents of these areas. Most of the rat control projects involve interdepartmental cooperation including public health, housing, public works, and poverty-fighting groups.

Following the initial survey to identify rat-infested areas and the contributing factors, a program is organized which incorporates permanent, long-range solutions to the

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Editor's note: This paper was presented at the Fourth Vertebrate Pest Conference (March 1970, West Sacramento, California), but through unavoidable delays the manuscript was not received in time to meet the printing deadline of the proceedings. I, therefore, have requested and received approval of the authors to include the paper in this proceedings just as it was originally written.

problems. Essential elements of the program provide for the involving of residents and property owners in the planning and programming activities; developing informational and training materials; establishing adequate codes and ordinances as well as their proper enforcement; insuring proper storage, collection and disposal of garbage and other types of refuse and instigating appropriate rat killing measures. A continuous evaluation of the various elements of the program is imperative.

The Environmental Health Service, Insect and Rodent Control Branch of DHEW<sup>1</sup> at Atlanta, Georgia, has completed its initial annual survey of the status of the program and will begin the second in the near future. In FY-1969, 15 Federal rat control project grants were awarded which involve 19 cities and a Seattle, Washington, environmental health project grant which includes a rat control program. The target area totalled more than 1 million premises and a population of 3.8 million people. Slightly over \$20 million of joint local and Federal funds were spent during the year.

In its first survey after the program had been in operation for a year, the EHS found that more than 60% of all the blocks in the target areas had exterior rat infestations. On the average, 16% of the premises contained active exterior rat signs. Interior rat infestations were found in up to a maximum of 46% of the individual premises in the target areas, and an average of nearly 40% of the premises had potential rat entries into living spaces.

In addition to the above-ground rodent problems encountered, an average of 20% of the sewer manholes inspected were positive for rat signs. From these data, together with rat bite information, it was estimated that about 20% of the 3.8 million people in the target areas were living in homes infested with rats.

Despite this rather dark picture, it is highly encouraging that, even in these limited geographic areas, the severity of the problem has been recognized and evaluated. Even more encouraging is the fact that control operations are active in nearly all of the participating cities. Improvements are being made in refuse storage, collection and disposal methods. Project directors have indicated that the living environment of the people is being substantially improved. They emphasize the importance of extensive public education and are attempting to secure the cooperation and participation of all the people living within the limits of the project areas. New and innovative approaches are being sought to implement the various program activities essential in carrying out a comprehensive rat control program.

The marked increase in commensal rodent control activities is not limited to the United States, but is apparent in many other parts of the world. The Technical Development Laboratories of the National Communicable Disease Center was asked by the World Health Organization to aid in formulating plans for a rodenticide testing procedure. This plan is now in operation and about 10 candidate rodenticides have entered the testing regime. The plan is divided into five "Stages." In brief, the first stage tests are designed to determine the acute or accumulative toxicity to white rats. Adult males are treated by gavage at dosage rates of 2 to 128 mg./kg. body weight. Those compounds which give complete kills at or below the highest dosage are moved on to the next stage (Stage II). Those that fail to meet this criterion for acute toxicants are formulated in ground laboratory food at 250 ppm for assessment as an accumulative rodenticide. The rats are furnished water and only the treated food for a maximum of 30 days. If the rats fail to eat the formulation or if fewer than 2/3 of them die, the compound is dropped from further study.

Stage II studies are designed to determine the acceptability of bait containing the toxicant and the optimum concentration for its use. These tests are conducted against individually caged, field-collected Norway rats. Equal amounts of treated and untreated laboratory chow are offered to the rats for 2 days in the case of acute rodenticides, or up to 30 days with the accumulative candidates. Based on the results, the compound progresses to the optimum bait concentration portion of this phase or is tried at higher concentrations. The optimum concentration test indicates what level is likely to give the best results under field conditions. Accumulative rodenticides are tested at concentrations indicated by the results of the earlier stage.

In the Stage III work, the acute or accumulative oral toxicity to other animals such as mice, guinea pigs, rabbits, hens, dogs, cats, and pigs is evaluated at a toxicology station in England.

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<sup>1</sup>The authors are indebted to this agency for the information presented on the surveys conducted in Federal Rat Control Program.

Stage IV is the initial, small-scale field test. Evaluations may be conducted in either rural or urban areas, but at our station the principal emphasis is placed on individual rural premises. Each candidate is tried on at least five premises per bait formulation. The type of bait chosen depends upon the species of rodent involved and the types of competing food-stuffs. An excess of bait is exposed for 2 nights, being replenished and relocated as necessary after the first night. On the second day, all baits are removed and destroyed. The efficacy of the rodenticide is based on the reduction of the rodent population as indicated by a pretreatment and a 1-week and 2-week posttreatment census. When the reduction is 85% or greater, control is considered excellent; 75-85% is good; 65-75% is fair; and below 65% is designated as poor. Observations on acceptability of the baits are also recorded.

The same procedures are used for accumulative rodenticides except that bait replenishment and relocation will be carried on for a 3-week period. Population estimates are continuous for the entire treatment period. In addition, a posttreatment census should be made 1 week after removing the baits.

Compounds which justify further study will advance to Stage V, which involves small towns, neighborhoods or similar areas. As you will have noted, the procedures followed in Stage IV are designed primarily to evaluate a number of compounds under field conditions where infiltration from untreated areas is not a problem. Thus, they are not always applicable to urban control operations, particularly with the acute toxicants. Stage V is intended to provide the "operational" evaluation and is the last step in the experimental work on rodenticide development.

One of the compounds which the Technical Development Laboratories has studied under our testing program is stabilized scilliroside glycoside. In the laboratory, field-collected Norway rats accept it much better than they accept red squill, to which it is closely related. In addition, laboratory tests indicated that bait or toxicant shyness should not develop with repeated applications in the field. Therefore, the two main disadvantages of red squill appear to have been overcome.

Nineteen field tests of stabilized scilliroside glycoside were conducted on premises on which hogs, chickens, cattle or dogs were present; in grain storage facilities; and in other rural habitats. No prebaiting period was used. The toxicant was mixed in a corn meal: oatmeal: corn oil bait and was offered for 2 nights. Good control (75-85%) was obtained on three of the tests and excellent control (85% or above) on the remaining 16.

Other interesting rodenticides are currently under test, but most are still in the laboratory stage. Several appear promising; one in particular appears to have some specificity for the roof rat, which in general is more difficult to control than the Norway rat. In free-choice tests with field-collected rodents, an 0.5% or 1.0% concentration of this toxicant killed only about 20% of the Norway rats. However, an 0.003% concentration under similar conditions killed all of the roof rats. An indication of the extreme toxicity of this compound to roof rats is evidenced by the fact that a concentration of 0.25% 1080 (sodium fluoroacetate) is required to kill 80% of the same species.

In addition to the rodenticide testing program, TDL is involved in research on other methods of control. The search for suitable and effective repellents has not been fruitful thus far. Additives to increase the attractiveness of baits likewise have failed to produce demonstrable progress.

The problem of resistance to anticoagulants has not yet arisen in this country. Routine periodic susceptibility tests should be conducted by a responsible agency, particularly in selected cities throughout the country. Based on experiences with such resistance in England and other countries, the earlier the resistant population is detected, the more likelihood there is that it can be eliminated.